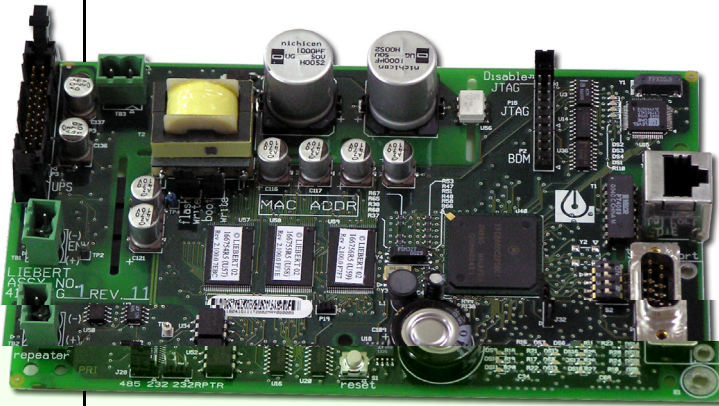


MONITORING

# OpenComms NIC

USER MANUAL





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## 1.0 INTRODUCTION

The OpenComms NIC Card transforms Liebert units into manageable nodes within your Network, NMS, and BMS systems.

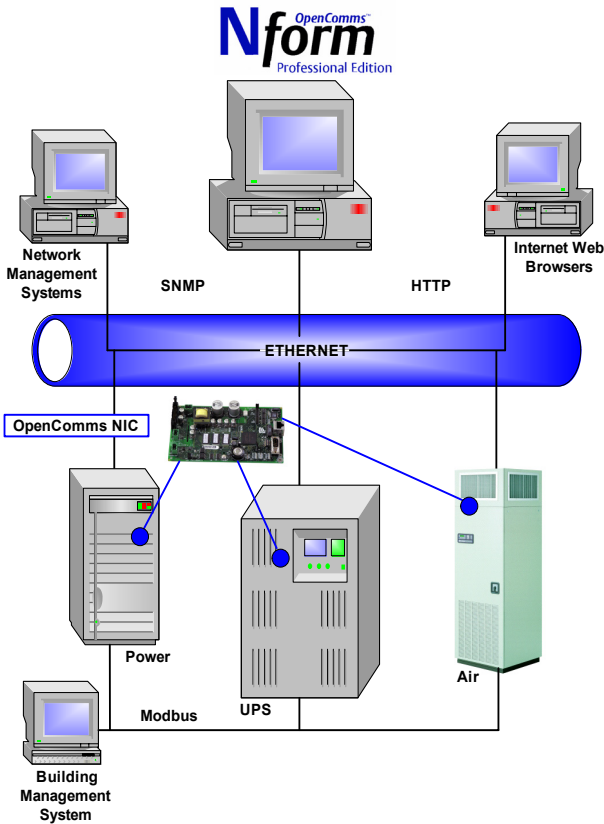
The OpenComms NIC Card contains a standard port designed to support viewing and management through:

- **HTTP** for Web browsers (I.E. 5.5 or later)
- **SNMP** (v1, v2c) for network management systems
- **Modbus RTU** for building management systems (and SiteScan)

For the first time, the system that monitors the status of your computing, communication and facility infrastructure can comprehensively monitor your Liebert equipment concurrently.

These standard open protocols allow simple integration into your monitoring system, leveraging prior infrastructure investments and established procedures.

**Figure 1 Typical installation of OpenComms NIC card**



## **1.1 OpenComms Compatibility**

The OpenComms NIC may be installed and used with these units:

### **Environmental Units**

- Deluxe System3—Advanced Microprocessor with Graphics, Advanced Microprocessor and standard microprocessor
- Challenger 3000—Advanced Microprocessor with Graphics, Advanced Microprocessor and standard microprocessor
- Mini-Mate2
- Level 00—Deluxe System3, Challenger 3000
- Level 10—Deluxe System3, Challenger 3000
- Level 05/15 (UK)
- Himod
- Emerson Network Power (CEMS100 / LECS15)

### **3-Phase UPS**

- Npower
- Hiross 7200 (Italy)
- Hiross HiPulse (Italy)

### **3-Phase Power**

- PDU with PMP or EPMP monitoring
- DataWave with PMP or EPMP monitoring
- Static Switch
- Static Switch2
- Static Switch2/PDU



**NOTE**



**Table 1 OpenComms availability**

Unit	Factory Option	Retrofit Kit	Retrofit Kit Part #
<b>Environmental Products</b>			
Deluxe System 3 and ICS	Yes	Yes	NIC-K-SYS3
Challenger	Yes	Yes	NIC-K-CHALL
Mini-Mate2		Yes <sup>1</sup>	NIC-ENCL1 OR 2
Level 00/05/10/15		Yes	NIC
Himod	Yes	Yes	NIC
Emerson Network Power (CEMS100 / LECS15)	Yes <sup>3</sup>	Yes <sup>3</sup>	Consult sales department
<b>3-Phase UPS</b>			
Npower	Yes	Yes <sup>2</sup>	37OP000NIC8
Hiross 7200 (Italy)	Yes	Yes <sup>2</sup>	4645114G
Hiross HiPulse (Italy)	Yes	Yes <sup>2</sup>	4645114d
<b>3-Phase power</b>			
PDU DataWave With PMP or EPMP		Yes <sup>1,2</sup>	NIC-ENCL1 OR 2
Static Switch		Yes <sup>1,2</sup>	NIC-ENCL1 OR 2
Static Switch 2	Yes	Yes <sup>2</sup>	STSNIC

<sup>1</sup> Requires an external enclosure assembly

<sup>2</sup> Contact your sales / service representative or liebert global services for installation.

<sup>3</sup> For Australian units, contact the international sales department @

[YC.KOK@emersonnetwork.com.au](mailto:YC.KOK@emersonnetwork.com.au)

Retrofit Kits are designed specifically for individual units. Consult your local Emerson and Liebert sales representative for pricing, part numbers and installation help.

**Table 2 Specifications**

<b>Electrical Requirements</b>	
Voltage	18 to 24VAC 50/60 Hz, Single Phase 12 to 36VDC
Power	6VA maximum
<b>Environmental Conditions, °F (°C)</b>	
Operating Ambient Temperature	41 to 104 (5 to 40)
Storage Ambient Temperature	-4 to 140 (-20 to 60)
Relative Humidity	10% to 90% RH (Non-condensing)
<b>Dimensions, Inches (mm)</b>	
Unit Only	7 x 4 x 1.5 (178 x 102 x 38)
As Shipped	9.75 x 7.0 x 2.5 (248 x 178 x 64)
<b>Weight, lb (kg)</b>	
Unit Only	0.4 (0.2)
As Shipped	1.3 (0.6)

## 2.0 INSTALLATION

The OpenComms NIC card may be ordered as a factory-installed option, and it may be installed as a kit for field retrofit to existing Liebert units or as a self-contained unit in its own enclosure.

If ordered as a factory-installed option, proceed to **2.3 - User Connections for OpenComms NIC**.

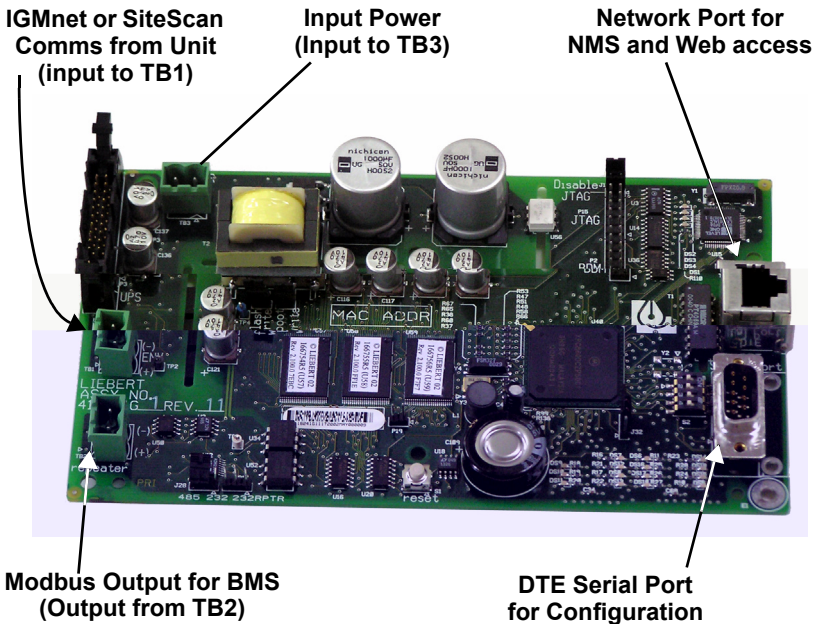
### 2.1 Retrofit Kit

As a retrofit kit, the circuit board is secured to a metal mounting plate. The mounting plate then is attached to a flat metal surface in a low-voltage section of the Liebert unit.

### 2.2 Self-Contained Unit

The self-contained model packages the interface card inside a steel enclosure, for mounting external to the Liebert unit. A low-voltage transformer is also provided.

**Figure 2 Connections**



## **2.3 User Connections for OpenComms NIC**

The OpenComms NIC can use simultaneous connections, sometimes requiring three user connections:

- Permanent network connection
- Modbus 485 connection
- Temporary serial connection for configuration/setup

### **2.3.1 Network Port**

Consult with the network administrator or other responsible party for arranging a network drop to the Liebert equipment. The OpenComms NIC communicates via standard 10 Base-T Ethernet network connection. Route the 10 Base-T cable to the Liebert unit and connect to J3, the RJ45 jack on the interface card. The OpenComms Network card will operate with any 10 Base-T Ethernet, regardless of operating system used.

### **2.3.2 BMS Port**

The Modbus 485 connection will use the terminals marked “Repeater.” (TB2) The Modbus server uses RTU protocol and will allow for a maximum of 32 units on 4000ft. of wire on a common line. EIA-485 repeaters may be necessary to accommodate additional units or longer cables. Point availability may be referenced in the document, “NIC Reference Library,” which may be downloaded at [www.liebert.com](http://www.liebert.com) under the OpenComms product family.

### **2.3.3 Configuration Port / Service Terminal**

A temporary serial connection to the interface card is necessary for configuration and setup.

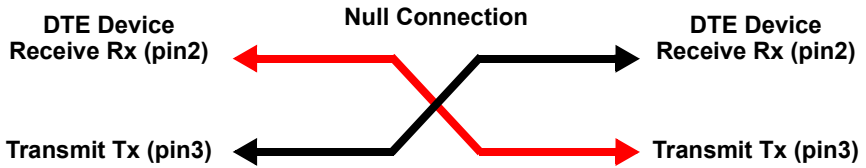
Using a DB9F-DB9F null-modem cable, connect the “DTE Serial Port” P18 to an ASCII terminal or computer running terminal emulation application. HyperTerminal® and Procomm® are examples of terminal emulation applications running on Microsoft Windows® operating systems. All trademarks are property of their respective owners.

## Accessing the Configuration Port


What you will need:

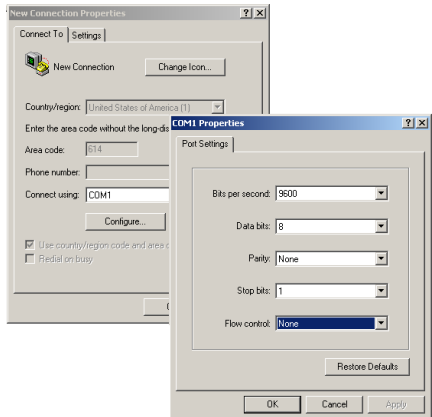
- PC capable of running a terminal emulation application, such as Microsoft Windows® HyperTerminal®.
- DB9 Null modem or file transfer cable. (The correct cable will have at a minimum, pins 2 and 3 crossed at the ends.) Null modem cables are commonly found in computer stores and may also be referred to as a file transfer cable.

**Figure 3 Null modem cable diagram**



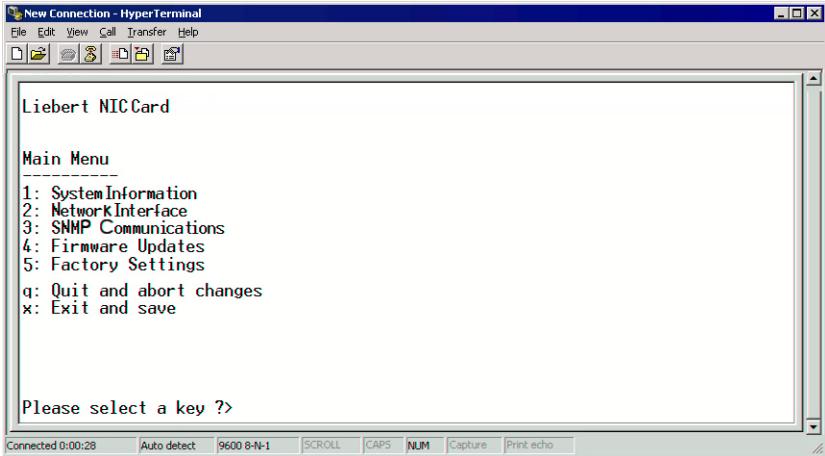
### NOTE

1. Launch HyperTerminal. When you see the screen at right, select **Cancel**.
2. Select the disconnect icon from the menu bar. This step ensures that you will be able to modify the configuration settings. 
3. Go to **File > Properties** to make configuration changes. Under the **Connect To** setting, choose the appropriate communications port for your computer. Generally this is Com 1.
4. Select the **Configure** button and adjust the terminal communication settings to:
  - Bits per second: 9600
  - Data Bits: 8
  - Parity: None
  - Stop Bit: 1
  - Flow Control: None
5. After the communication settings are adjusted, press



the **Enter** key on your keyboard. This will initiate communications with the card and the following screen should be displayed.

**Figure 4 NIC main menu in HyperTerminal**



(You can also cycle power on the OpenComms NIC card. This will also initiate communications and provide information on current revision status.)

6. When the message **“Initializing Network...”** appears, hit the **Enter** key on your keyboard. (Additional network information may appear)



## CAUTION

Cycling power on either the 7200 or the HiPulse UPS is not recommended unless the unit is in bypass mode. Consult the UPS user manual for further instructions.

## 3.0 SYSTEM CONFIGURATION

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### 3.1 DIP Switch Settings

A four-position DIP switch is provided, but no user configuration via DIP switches is necessary at this time.

### 3.2 Service Terminal

Refer to **Accessing the Configuration Port on page 7** for explicit details on accessing the service terminal / configuration port.

By default, the service terminal communication parameters are:

- 9600 bps
- No parity
- 8 data bits
- 1 stop bit
- Flow Control: None

After connecting to the OpenComms NIC card, press the space bar or **<Enter>** key to activate the service terminal session. If no response is apparent and you have verified connectivity, cycle power on the OpenComms NIC and the service terminal sessions should appear automatically.



### CAUTION

Cycling power on either the 7200 or the HiPulse UPS is not recommended unless the unit is in bypass mode. Consult the UPS user manual for further instructions.

**Table 3 Service terminal navigation**

**Main Menu**

- 1. System Information
  - 1.1 Name
  - 1.2 Contact
  - 1.3 Location
  - 1.4 Description
- 2. Network Settings
  - 2.1 Boot / IP Settings
    - 2.1.1 Boot Mode
      - 2.1.1.1 Static
      - 2.1.1.2 BootP
      - 2.1.1.3 DHCP
    - 2.1.2 IP Address
    - 2.1.3 Netmask
    - 2.1.4 Default Gateway
  - 2.2 SNMP Communications
    - 2.2.1 SNMP agent (enable/disable)
    - 2.2.2 Authentication Traps (enable/disable)
    - 2.2.3 Display / Modify Communities
    - 2.2.4 Display / Modify Trap Communities
  - 2.3 Web Server
    - 2.3.1 Web Server (enable/disable)
    - 2.3.2 Configuration Control (enable/disable)
    - 2.3.3 Refresh rate
  - 2.4 Telnet Server
    - 2.4.1 Telnet server (enable/disable)



## System Information Menu

The System Information Menu seeks descriptive input to enable the unit to be identified. This data is readable via SNMP queries. The (“ character is not permitted in any of the descriptive fields

## Network Settings Menu

The Network Settings Menu configures network parameters essential for proper network operation. The network administrator or other personnel responsible for the network should be consulted for the proper parameters to be entered in this menu.

In the static mode, the IP address is entered. Use the standard four-part dotted decimal format. The NetMask and Default Gateway should also be entered in dotted decimal format. The NetMask, also known as subnet mask, delineates devices on the same physical network segment, versus devices that require the services of a network router for access to other networks. The Default Router is the address of default router on the local segment.



### CAUTION

Consult your network administrator to ascertain the parameters appropriate to your network.

## BOOTP and DHCP Mode

The OpenComms NIC supports DHCP and BOOTP if a DHCP or BOOTP server must exist on the network. When this feature is enabled, at boot-up the card will perform a DHCP or BOOTP request for configuration information, including automatic assignment of an IP address. If the card receives the information, no further requests are made. If, at boot-up, a response is not received, the card will continue to send a request approximately every 30 seconds until a response is received. When this condition is encountered, pushing the <Enter> key returns the unit to the service terminal mode.

## SNMP Communications Menu

The SNMP (Simple Network Management Protocol) Communications Menu specifies parameters particular to the SNMP interface. Communities are used as a means of security for SNMP v1; only specified hosts with the appropriate community name(s) are allowed to perform particular SNMP operations. Up to 20 different communities can be assigned.

For each community, specify the dotted decimal IP address of the remote host, the privilege level (read or read/write), and community name. Trap Communities specify the recipient(s) of SNMP trap messages generated by the OpenComms Network Interface Card. Typically; the recipient is the management station of the NMS. Specify the

destination IP address, and the community name for that host. Up to 20 trap communities can be assigned. For Communities and Trap Communities, the information can be entered as a “complex” line — all parameters space-delimited on the command line. Otherwise, the menu items will prompt for each individual parameter.

**NOTE**

Authentication failure traps may be enabled, so that the network management system can be warned when unauthorized access (i.e.: incorrect community name) is attempted.

**Web Server**

The Web Server section will allow the user to disable / enable the HTTP session for the card. Disabling the Web Server means that web browsers will not be able to access the devices status graphical page (GUD).

**Telnet**

This section allows users to enable or disable the Telnet session.

**Change User Name / Password**

This section allows users to set or change the default user name and password.

- Default user name is “Liebert” (case sensitive).
- Default password is “Liebert” (case sensitive).

**Firmware Updates Menu**

The Firmware Update Menu is intended for Liebert service personnel only. No user configurable parameters are accessed in this selection. If entered, to escape, power must be cycled on the card.

**Factory Settings Menu**

The Factory Settings Menu displays the manufacture date, serial number and MAC address of the card. These parameters are read-only. Once all parameters have been entered, press **Escape** to return to the Main menu; then press **x** to save configuration, exit and reboot to enable the new configuration. All parameters are stored in non-volatile flash memory. Pressing **q** after **Escape** will abort all changes. Neither selection is case-sensitive.

## **Auxiliary Communications**

The Auxiliary Communications Menu allows the user to set up the parameters necessary for Modbus communications. The user can enable / disable the Modbus sessions as well as assign the slave ID.

**Q.** <q> will abort all changes.

**X.** <x> will save configuration changes.

Once all parameters have been entered, press <escape> to return to the Main menu; then press exit and reboot using the new configuration. All parameters are stored in non-volatile flash memory.

Neither selection is case-sensitive.

---

## **4.0 OPERATION**

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### **4.1 SNMP**

The OpenComms Network Interface Card supports “get,” “getnext,” “set,” “response” and “trap” packets of SNMP (Simple Network Management Protocol). The OpenComms NIC supports MIB-II, RFC1628 and Liebert Global Products MIBs. The terms “alarms” and “conditions” will be used interchangeably through out this description. Alarms are generated and maintained through the RFC 1628 UPS MIB. Conditions are generated and maintained through the Liebert Global Products MIB.

The RFC 1628 UPS MIB provides information for the supported UPS devices. The Liebert Global Products MIB provides information for the supported environmental devices. All conditions that are listed are dependent upon what the unit itself supports. When a condition occurs within the unit, it is logged into the condition table within the appropriate MIB and a unique ID is assigned. A description of the condition along with the value of the system up-time when the condition was generated is placed into the table as well. A trap is then sent out to the monitoring system.

### **4.2 Liebert Global Products MIB**

Environmental units log conditions in the Liebert Global Products MIB. Traps for the environmental units are generated out of the Liebert Global Products MIB. Currently, there are only two traps that are sent for environmental units through the MIB: Event Condition Entry Added and Event Condition Entry Removed. The Event Condition Entry Added is sent each time a condition is inserted into the conditions table. This trap provides the condition ID, the condition description, and the condition time. The Event Condition Entry Removed is sent each time a condition is removed from the conditions table. This trap provides the condition ID, the condition description, and the condition time.

### 4.3 RFC 1628 UPS MIB

UPS units log alarms in the RFC 1628 UPS MIB. Traps for the UPS units are generated out of the RFC 1628 UPS MIB. There are four traps that may be sent for the UPS units: Trap On Battery, Trap Test Completed, Trap Alarm Entry Added and Trap Alarm Entry Removed.

The trap On Battery is sent when the UPS is operating on battery power. This trap will be sent once a minute until the UPS either shuts down or is no longer running on battery power. This trap provides the Estimated Minutes Remaining on Battery, the Seconds on Battery and the Configured Low Battery Time. The Trap Test Completed is sent when a UPS diagnostic test is completed. This trap provides the Test ID of the test that has been performed, the Test Spin Lock, the Test Results Summary, the Test Results Detail, the Test Start Time and the Test Elapsed Time. The Trap Alarm Entry Added is sent when an alarm is placed into the alarm table and provides the alarm ID and the alarm description. This trap is **not** sent on the following alarms: On Battery and Test In Progress. The Trap Alarm entry Removed is sent when an alarm is removed from the alarm table and provides the alarm ID and the alarm description. This trap is **not** sent out when the Test In Progress alarm is removed from the alarm table.

#### 4.3.1 SNMP Traps

Below is the definition on how events are handled in RFC1628.

\* Two similar event traps (notifications) are sent to their destination or NMS system. The event traps are differentiated by their trap type. Type 3 = Condition ADDED to the event table, Type 4 = Condition REMOVED from the event table.

\*Each event trap contains the following three bindings of information:

1. Trap ID. The ID represents the location or placeholder in the table to find event information.
2. The OID reference of the well-known alarm. Note: Below are the OID references for RFC1628 alarms. These are not Liebert-unit specific, but rather RFC1628 specific.
3. Time ticks or system uptime that represents when an event occurred.

**[OIDALARMS]**

- 1.3.6.1.2.1.33.1.6.3.1:upsAlarmBatteryBad{}
- 1.3.6.1.2.1.33.1.6.3.2:upsAlarmOnBattery{}
- 1.3.6.1.2.1.33.1.6.3.3:upsAlarmLowBattery{}
- 1.3.6.1.2.1.33.1.6.3.4:upsAlarmDepletedBattery{}
- 1.3.6.1.2.1.33.1.6.3.5:upsAlarmTempBad{}
- 1.3.6.1.2.1.33.1.6.3.6:upsAlarmInputBad{}
- 1.3.6.1.2.1.33.1.6.3.7:upsAlarmOutputBad{}
- 1.3.6.1.2.1.33.1.6.3.8:upsAlarmOutputOverload{}
- 1.3.6.1.2.1.33.1.6.3.9:upsAlarmOnByPass{}
- 1.3.6.1.2.1.33.1.6.3.10:upsAlarmBypassBad{}
- 1.3.6.1.2.1.33.1.6.3.11:upsAlarmOutputOffAsRequested{}
- 1.3.6.1.2.1.33.1.6.3.12:upsAlarmUpsOffAsRequested{}
- 1.3.6.1.2.1.33.1.6.3.13:upsAlarmChargerFailed{}
- 1.3.6.1.2.1.33.1.6.3.14:upsAlarmUpsOutputOff{}
- 1.3.6.1.2.1.33.1.6.3.15:upsAlarmUpsSystemOff{}
- 1.3.6.1.2.1.33.1.6.3.16:upsAlarmFanFailure{}
- 1.3.6.1.2.1.33.1.6.3.17:upsAlarmFuseFailure{}
- 1.3.6.1.2.1.33.1.6.3.18:upsAlarmGeneralFault{}
- 1.3.6.1.2.1.33.1.6.3.19:upsAlarmDiagnosticTestFailed{}
- 1.3.6.1.2.1.33.1.6.3.20:upsAlarmCommunicationsLost{}
- 1.3.6.1.2.1.33.1.6.3.21:upsAlarmAwaitingPower{}
- 1.3.6.1.2.1.33.1.6.3.22:upsAlarmShutdownPending{}
- 1.3.6.1.2.1.33.1.6.3.23:upsAlarmShutdownImminent{}
- 1.3.6.1.2.1.33.1.6.3.24:upsAlarmTestInProgress{}

To summarize, event traps generally are parsed by the NMS for any of the information contained in the trap. A process should be put in place by the NMS to recognize whether the event trap is a new condition or a cleared condition by looking at the trap type. Likewise, the NMS should be able to extract the second binding of the trap notification to see the OID of the well-known alarm. This OID reference will allow the NMS to extract the well-known name or description of the event.

## **4.4 MIB**

The Management Information Base (MIB) is a formal document declaring the specifics of the information supported by the SNMP implementation. The administrator for the NMS (or other applications utilizing SNMP to communicate with the Liebert units) will need the MIB in order to integrate the Liebert units into the monitoring system.

The MIB files are contained on the CD that ships with the product.

Alternatively, the MIBs for the OpenComms Network Interface Card are available for download at [www.liebert.com](http://www.liebert.com). Navigate through Products, then Site Monitoring & Software and proceed to the OpenComms support information area. The RCF 1628 MIB can be downloaded at [www.ietf.org](http://www.ietf.org).

## **4.5 HTTP**

Status and alarm information can be queried by Web browsers via HTTP v1.1 (Hyper Text Transfer Protocol). The data is shown in an intuitive graphical format, akin to the unit's front bezel controls. These browsers have been tested and are supported:

- Microsoft Internet Explorer, versions 5.x and later
- Limited Support for: Netscape 6.0 & Opera 5

Font size may need to be adjusted on your browser for optimal viewing.

With appropriate NMS software and configuration, the user on reception of SNMP traps may view HTTP pages in order to view the overall operating status of the unit – or HTTP may be used on its own to monitor “on-demand” the unit operation. HTTP pages will automatically refresh (reload) every 20 seconds and is adjustable through the service terminal program.

## **4.6 Modbus RTU**

See **5.0 - Modbus Communications and Connectivity** for a complete explanation of the Modbus slave.

## **4.7 System Reset**

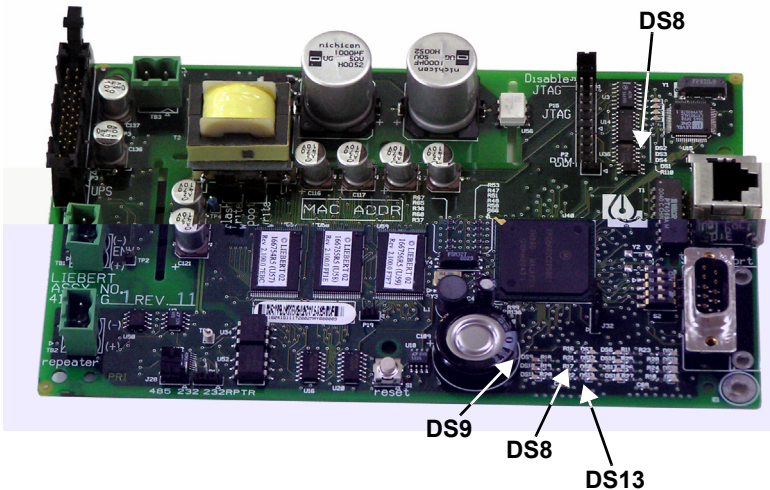
The OpenComms Network card contains an on-board real time clock and watchdog circuitry. The card is self-monitoring and self-correcting. However, a push button is provided to permit a manual system reset. The reset push button is labeled S1 on the interface card: press and hold it for 3 seconds before releasing to initiate hardware reset.

## 4.8 Diagnostics

A number of LEDs are provided on the interface card to provide information for diagnostic purposes. The following table summarizes their indications:

LED Identifier	Description
DS1	Ethernet Port Collision
DS2	Ethernet Port Receive
DS3	Ethernet Port Transmit
DS4	Ethernet Port Link
DS5	Not used
DS6	Not used
DS7	Repeater Port Receive
DS8	IGM Port Receive
DS9	Microprocessor in Operation
DS10	Serial Port Receive
DS11	Serial Port Transmit
DS12	Repeater Port Transmit
DS13	IGM Port Transmit
DS14-19	Not used

Figure 5 LED locations





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## **5.0 MODBUS COMMUNICATIONS AND CONNECTIVITY**

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This section describes the Modbus communications protocol as supported by the OpenComms NIC card. It includes information on how to pass information to and from the OpenComms NIC card via Modbus. It is also intended to help facilitate answering questions regarding supported types, frame format, function code support etc.

### **5.1 Implementation Basics**

Protocol controls the language structure or message format between devices in other words, the rules for communication. The rules for communication include how master and slave devices initiate communications, as well as unit identification, message handling and error checking. Modbus protocol simply refers to the control of the query and response cycles between master and slave devices.

The OpenComms NIC module is configured to act as a slave device on a common network. The common network is a multi-drop or “daisy chain” configuration over EIA-485, where multiple slaves reside on a common wire or loop.

#### **5.1.1 Constraints**

The OpenComms NIC communicates with local database and therefore is subject to the time delay resulting from the local database updating policies. Use of “Preset Multiple Holding Registers” and Preset a single Holding Register functions requires accessing the Liebert device connected and to the OpenComms NIC card database service. Users should be aware that the Modbus application coexists with other on-board application servers (HTTP and SNMP specifically) and competes for the database service and CPU time. This may lead to uncertainty of responding time of the OpenComms NIC. The user or third party integrator may have to compensate for the delay time if HTTP, SNMP and Modbus are going to be utilized simultaneously.

### **5.2 Transmission Format**

The OpenComms NIC module supports Modbus RTU (Remote Terminal Unit) transmission modes. The OpenComms NIC communication rate is fixed at 9600 baud, 8 data bits, No parity, 1 Stop bit. The communication media is fixed using EIA-485 standards.

### **5.3 Physical Connection**

A Modbus network should consist of one, and only one, host client, and up to 255 slaves uniquely identifiable by their slave ID. The slave ID of each OpenComms NIC is set through the service terminal (configuration) port. (See section 3, System Configuration for more details.)

The OpenComms NIC supports multi-drop connection over RS485. On the OpenComms NIC, a client should connect to the OpenComms NIC as a multi-drop connection via the RS485 “Repeater” port (TB2), (Pin1 as minus and Pin2 as plus. J28-1 and J28-2 should be shorted.)

The OpenComms NIC card is designed to reside on a maximum common line of 32 devices with a total cable length of 4000 feet. In a “normal environment” all devices should be connected in “daisy-chain” fashion, with “star configurations” or branches, being used at a minimum. See **Figure 6** for details. A “normal environment” consists of an installation where noise or electrical interference is minimal. This is typical of communication wiring run in properly grounded conduit or in areas where high voltage or radio transmissions are not present. Otherwise, these conditions are designated as “noisy.”

#### **Figure 6 Typical maximum installation**

The recommended cable characteristics are:

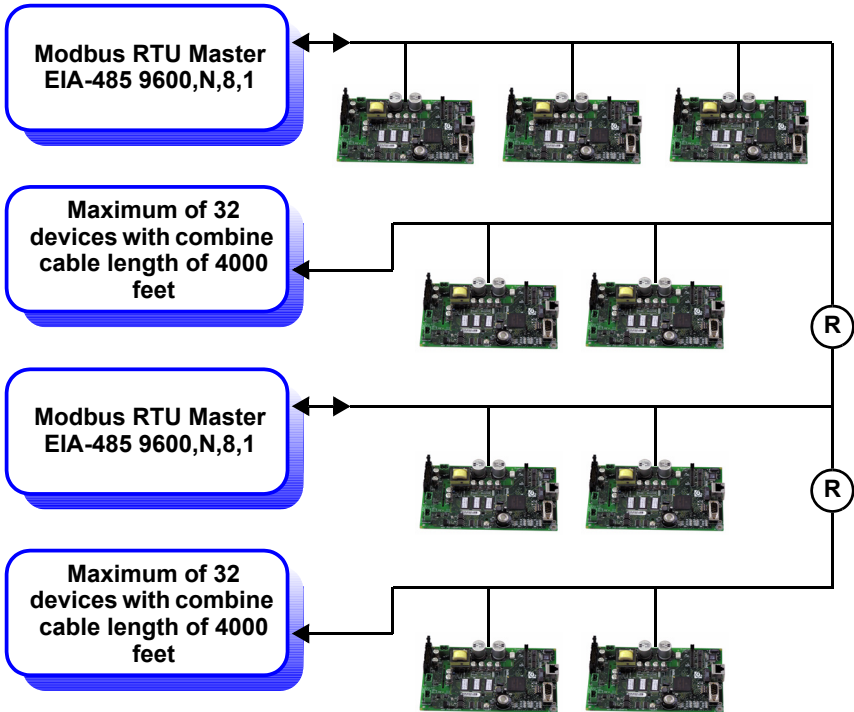
Normal Environments:

- 18-22 gauge, twisted-pair, stranded (non- shielded)  
Typical type is: Belden 8442

Noisy Environments:

- 18-22 gauge, twisted-pair, stranded (shielded)  
Typical type is: Belden 9461

Figure 7 Exceeding maximum specifications



The maximum specification may be exceeded if measures are taken to drive or boost the EIA-485 communication line. Two wire EIA485 repeaters are available through the Liebert Corporation. SiteScan’s “REPOPT” will work sufficiently for this application. Consult the SiteScan price book for pricing schedule and alternative solutions.

## 5.4 Modbus Slave Functions

### 5.4.1 Data Type

The OpenComms NIC supports data in a register block as one of the following types: Signed integer (16 bit) / Unsigned integer (16 bit) / Signed long (32 bit); IEEE floating-point (32 bit); Null terminated String.

A datum should consist of one or multiple registers. The leftmost byte contains the MSB and the rightmost byte contains the LSB.

## **5.4.2 Function Code Support**

The OpenComms NIC implements the following Modbus functions. However, integrators will use function code 0x03, and 0x06 most often due to the type of data to be acquired.

0x01	Read Coil Status
0x02	Read Input Status
0x03	Read Holding Registers
0x04	Read Input Registers
0x06	Write Single Holding Register
0x0F	Force Multiple Coils
0x10	Preset Multiple Holding Registers

### **5.4.3 Read/Write Holding Registers (0x03, 0x06, 0x10)**

A holding register is a 16-bit message unit. In principle, a message in a holding register is write / readable, but holding registers can be used by read-only data as well. Holding registers are mapped into 40001-49999 logic address range.

Holding registers can be read by function code 0x03. A maximum of 125 registers can be read by a single query.

Function code 0x06 requests the server to change the content of a single holding register, and function code 0x10 requests server to change the contents of multiple holding registers adjacent to each other.

### **5.4.4 Read Input Registers (0x04)**

The input register block contains read-only data accessible to the user. A datum in the input register block occupies one or multiple registers such as described in the previous section. The input registers are mapped into 30000-39999 of the logic address range.

Up to 125 input registers can be read by a single query using function code 0x04.

### **5.4.5 Read, Set Coil Status (0x01, 0x05, 0x0F)**

Coil status contains bit-mapped status accessible to the users. In principle, a coil status can be read, set or cleared by the host client. Multiple coil status can be read by specifying the index of bits of the first coil and the number of consecutive coils in a single query.

Coil status can be read by function code 0x01.

Function code 0x05 set or clear a single coil, and function code 0x0F set or clear multiple coils.

### **5.4.6 Read Input Status (0x02)**

The input status block contains read-only status accessible to the users. It can be read by using function code 0x02 in the same as reading coil status.

### **5.4.7 Error Handling**

According to the Modbus specification, the OpenComms NIC composes the following exception responses to the client if an exception or error occurs.

**Table 4 Exception response**

<b>Server Address</b>	<b>Function Code (0x80)</b>	<b>Exception Code</b>	<b>16 Bit CRC</b>
1 byte	1 byte	1 bytes	2 bytes

Exception codes are:

- 01: Unsupported function code
- 02: Out-of-range data addresses
- 03: Out-of-range data value (write to holding registers)
- 04: There is currently no LMD device connected to the server
- 05: Server is composing response but cannot response to the client within the time limit required by Modbus specification.

### **Modbus Packet Formats**

Each Modbus packet consists of the following fields:

- Device Address
- Function Code
- Data Field(s)
- Error Check Field

#### **Device Address**

The address field immediately follows the beginning of the frame and consists of 8-bits. These bits indicate the user assigned address of the slave device that is to receive the message sent by the attached master device.

Each slave OpenComms NIC must be assigned a unique address and only the addressed slave will respond to a query that contains its address.

#### **Function Code**

The function code field tells the addressed slaves what function to perform. Function codes are specifically designed invoke a specific action by the slave device. The function code range is from 1 to 127. However,

the OpenComms NIC module primarily uses Function Code 3 (Read Holding Registers) and Function Code 6 (Preset Single Register).

### **Data Field(s)**

The data field varies in length depending on whether the message is a request or a response to a packet. This field typically contains information required by the slave device to perform the command specified or to pass back data to the master device.

### **Error Check Field**

The Error Check Field consists of a 16-bit (2 byte) Cyclical Redundancy Check (CRC16). It allows the receiving device to detect a packet that has been corrupted with transmission errors.

## **5.5 RTU Framing Examples**

### **5.5.1 Read Registers (Function Code 0x03 & 0x04)**

**Query:** for reading holding /input registers (requested by a client)

<b>Server Address</b>	<b>Function Code (0x3/0x4)</b>	<b>Index of starting register</b>	<b>Number of registers to be read</b>	<b>16 bit CRC</b>
1 byte	1 byte	2 bytes	2 bytes	2 bytes

**Response:** for reading holding/input registers (response by the server)

<b>Server Address</b>	<b>Function Code (0x3/0x4)</b>	<b>Byte Count</b>	<b>Data from registers</b>	<b>16 bit CRC</b>
1 byte	1 byte	1 byte	2*m bytes (= Byte Count)	2 bytes

### **5.5.2 Write single holding register (Function Code 0x06)**

**Query:** for writing a single holding register (requested by a client)

<b>Server Address</b>	<b>Function Code (0x06)</b>	<b>Index of the register</b>	<b>16 bit value to be written</b>	<b>16 bit CRC</b>
1 byte	1 byte	2 bytes	2 bytes	2 bytes

**Response:** for writing a holding registers (response by the server)

<b>Server Address</b>	<b>Function Code (0x06)</b>	<b>Index of the register</b>	<b>16 bit value been written</b>	<b>16 bit CRC</b>
1 byte	1 byte	2 bytes	2 bytes	2 bytes

## **6.0 NIC SETUP AND TESTING**

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The NIC has a specific setup that must be in place before the card will function properly. There are jumpers on the board that must be in the correct locations. The positions of these jumpers are numbered on the board itself. A small triangle silk

## **6.2 Testing the Network**

“Ping” is a tool used to test the network. At the command prompt, type, “ping <address of card>”. Ping will respond that it received a reply from the card if the card is functioning properly on the network. If the card is not functioning properly or is not connecting to the network, ping will respond that the request it sent to the card has timed out.

If the ping request times out, go to the Service Terminal to verify that the card initialized the network when it powered up. If the card is sitting at the text “Initializing network...” then the card has not connected to the network. Hit <enter> to go into the Service Terminal. Select No. 2 for the Network Interface Menu. Verify that you have the boot mode set up correctly. If you choose a static IP Address, verify that the IP Address is valid for your network.

If you obtain your network information from a BootP or DHCP server, verify that the server is valid and that it is responding to requests. Once the information has been verified, press <escape> to return to the main menu and select “x” to exit out of the card. Then, reboot the card. The card may be rebooted by pressing switch S1 on the card for approximately 2 seconds until the DS9 link light turns off.

If the card still does not connect to the network, or ping still does not receive a reply from the card, verify proper set up on the card itself. DS4 should be illuminated if the card detects the network. Verify that the network cable is connected to Ethernet port J3 and that the hub/router/switch to which the card is connected is operating correctly.

Once this information is verified, reboot the card.

## **6.3 Service Terminal Troubleshooting**

If the card does not bring up a Service Terminal, check link light DS9. DS9 should be illuminated within approximately 0.5 seconds of application of power. If DS9 is not illuminated and no other LED's are on, verify that power has been applied to the card. If power has been applied, verify wiring connected to TB3 is correct. TB3 should have 24VAC or 12 VDC applied. Reboot the card once the power to the card has been verified.

## **6.4 SNMP Troubleshooting**

If SNMP is not functioning, first make sure that the card powers up, the Service Terminal is functioning and the card is connected to the network (verified by using ping). If all of those conditions are met, verify that the community strings are set up correctly. To do this, go into the Service Terminal and select number 3 for SNMP Communications.



Then, select number 2 for Display/Modify Communities. Verify that the IP Addresses listed are valid for your network. Verify that you are typing in the correct community name when trying to access SNMP. The community name is case sensitive.

Once this information is verified, reboot the card and try to access SNMP again.

## **6.5 Web Troubleshooting**

If the card does not serve up a web page, but the Service Terminal is functioning, SNMP is functioning, and the card is connected to the network (verified through ping), then reboot the card. In this case, the web server has been lost and needs to be restarted.

If the card serves up a web page, but the web page only displays “Discovering connected device...” verify that the card is connected to the desired device. Verify that the link lights DS13 and DS8 are blinking on and off. DS13 indicates that the card is receiving from the connected device. DS8 indicates that the card is transmitting to the connected device.

If neither of the link lights is blinking, check the connection between TB1 and P3. TB1 is used to interface to the Environmental units and to some UPS's. P3 is used to interface with some UPS's. If DS13 is blinking and DS8 is not, this indicates a communication problem between the card and the connected device.

When this occurs, replace the NIC card and retry connecting to the Web. If the problem persists, change the card in the device that the NIC card is trying to interface with. Try to reconnect to the Web.

## **6.6 Modbus Troubleshooting**

If the card does not respond to Modbus requests, verify that DS7, “repeater port receive” is flashing during a request. In proper communications DS12 will also be flashing indicating, “repeater port transmit.”

Verify proper wiring on the EIA 485 network. OpenComms NIC cards should observe a “plus to plus” and “minus to minus” daisy chain configuration.

Also verify that the proper slave ID has been set in service terminal. Refer to **3.2 - Service Terminal** for initiating a service terminal session.

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## 7.0 FIRMWARE UPDATES

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The firmware in the OpenComms NIC card can be updated to take advantage of the latest release of software that may contain feature enhancements, new unit compatibility or service patches. The firmware is updated through the OpenComms NIC cards' serial port, using a terminal emulation program like HyperTerminal in MS Windows Operating Systems. This procedure has multiple steps and requires that 3 files be downloaded to the OpenComms NIC card. The latest firmware can be found at this link on the Liebert Web site:

<http://www.liebert.com/dynamic/displayproduct.asp?id=998&cycles=60Hz>



### CAUTION

Read all instructions before attempting a firmware download.


### 7.1 Establishing Communication—Necessary Components

- PC capable of running a terminal emulation application, such as HyperTerminal.
- DB9 null modem or file transfer cable. (The correct cable will have at a minimum, pins 2 and 3 crossed at the ends.)
- Firmware update files (3 files total with extensions of .s19)



### NOTE

## 7.2 Establishing Communication—Service Terminal Settings

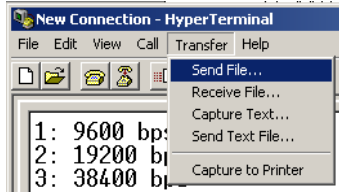
1. Launch HyperTerminal. Once you see the following screen, select **Cancel**.
2. Select the **disconnect icon from the menu bar** . This step ensures that you will be able to modify the configuration settings.
3. Go to **File > Properties** to make configuration changes. Under the **Connect To** setting, choose the appropriate communications port for your computer. Generally this is Com 1.
4. Select the **Configure** button and adjust the terminal communication settings to:
  - Bits per second: 9600
  - Data Bits: 8
  - Parity: None
  - Stop Bit: 1
  - Flow Control: None
5. Select **OK** to close both windows.



## 7.3 Firmware Update Procedure

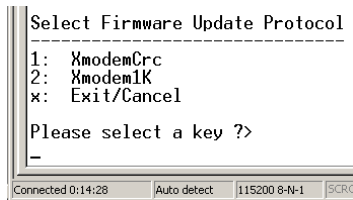
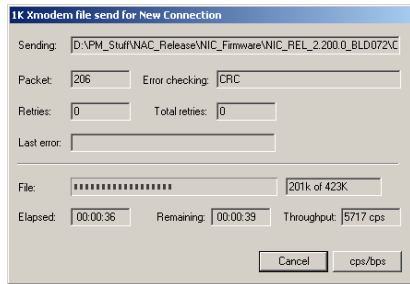
1. After the communication settings are adjusted, press the **Enter** key on your keyboard. This will initiate communications with the card and display the screen at right.  
You can also cycle power on the Open-Comms NIC card. This action will also initiate communications and provide information on current revision status.  
Once the “

8. When the above prompt is displayed, start the file download process by selecting **Transfer – Send File...** from the HyperTerminal menu, as shown at right.
9. Select **Xmodem** for the **Protocol** and browse to locate the file
10. Click on **Send** in the dialog box.



 **NOTE**

11. The screen at right will appear when the download begins. The screen will display the download progress, disappearing when the download is complete.
12. Once the file has completed downloading, a prompt will ask whether you wish to continue. Select **Y** to continue.
13. Select option **2** for **Xmodem1K** to facilitate a faster download for the remaining files. Press **Enter** twice to initiate the download of the second firmware file.
14. Select **Transfer – Send File...** from the HyperTerminal menu.
15. Select **1K Xmodem** for the protocol and browse to the location of:



16. Select **Send**; a progress prompt will be displayed.
- Repeat **Steps 11** through **16** to download the third firmware file. It is named
- The last file is the largest of the three and will take approximately 20 minutes to download.

Once the last file is downloaded, the screen at right will appear.



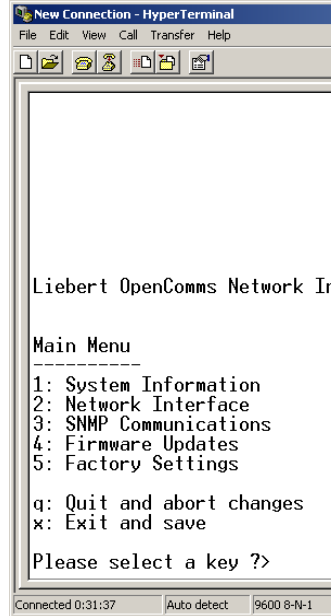
Repeat **Steps 2** through **4** to change the baud rate back to 9600 bps as show in the illustration below right.

After the communication settings are adjusted, hit the **Enter** key on your keyboard. The screen at right will appear.

You can also cycle power on the OpenComms NIC card. This action will also initiate communications and provide information on current revision status. Once the **“Initializing Network...”** line appears, hit the **Enter** key on your keyboard.

Select **X** and the card will reboot.

To ensure that the latest firmware is downloaded to the OpenComms NIC card, cycle power by removing and restoring the power connection at TB3. The information below will appear.



(C)Copyright 2000-2003 Liebert Corporation, All Rights Reserved

Build Label .....: NAC\_REL\_2.200.0\_BLD\_074

```
Software Version Number ..: v2.200.0
Source Control Number ...: 00016421
Product ID .....: 00000001
Hardware ID .....: 00000001
Header Revision Number ..: 00000001
Firmware Checksum .....: 0x5BCE
```

\*\*\*\*\*

```
Calculating Boot Checksum
Boot Checksum:          0xAAD1
Saved Boot Checksum:    0xAAD1
Checksum Valid
```

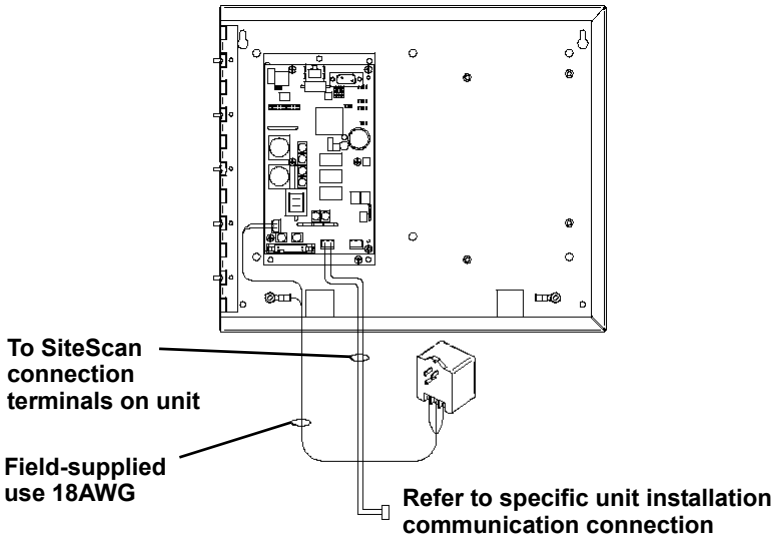
```
Calculating Application Checksum
Application Checksum:    0x5BCE
Saved Application Checksum: 0x5BCE
Checksum Valid
```

## 8.0 EXTERNAL ENCLOSURES

### 8.1 Power Connection

Power for the OpenComms Network card should be sourced from the supplied wall-plug transformer. Use field-supplied wiring to connect the outer terminals on the transformer to the screw connectors at TB3 on the Network Interface card. A field-supplied ground wire attaches to the center terminal on the transformer and connects to the ground-ing stud in the lower corner of the enclosure.

**Figure 9 NIC-ENCL1 internal view**



### 8.2 Communication Connection

Communications to the OpenComm Network Card is generally established by using the unit's SiteScan interface port. The specifics on location and wiring details can be found in the respective unit's user manual.

The unit's communications port is EIA-422, which measures ~3-5VDC between the positive and negative terminals. The connection is polarity sensitive, so use a voltmeter to verify polarity. The connection is positive-to-positive and, negative-to-negative-. The result when the card and the unit are connected together, a voltmeter will measure ~ 3-5 VDC. Once proper communication has been established, voltage readings will fluctuate.

## 9.0 RETROFIT INSTALLATION

### 9.1 Environmental Installation

Retrofit kits are designed specifically for individual units. Consult your local Liebert representative for pricing, part numbers and installation help.

#### 9.1.1 Deluxe System/3

Position the OpenComms card in the low voltage/control cavity of the Liebert Deluxe System 3 unit. Refer to **Figures 10, 11 and 12** for typical positioning. Use three #8 x 1/2" sheet metal screws to affix mounting plate to the environmental unit.

**Figure 10** Deluxe System 3 NIC installation

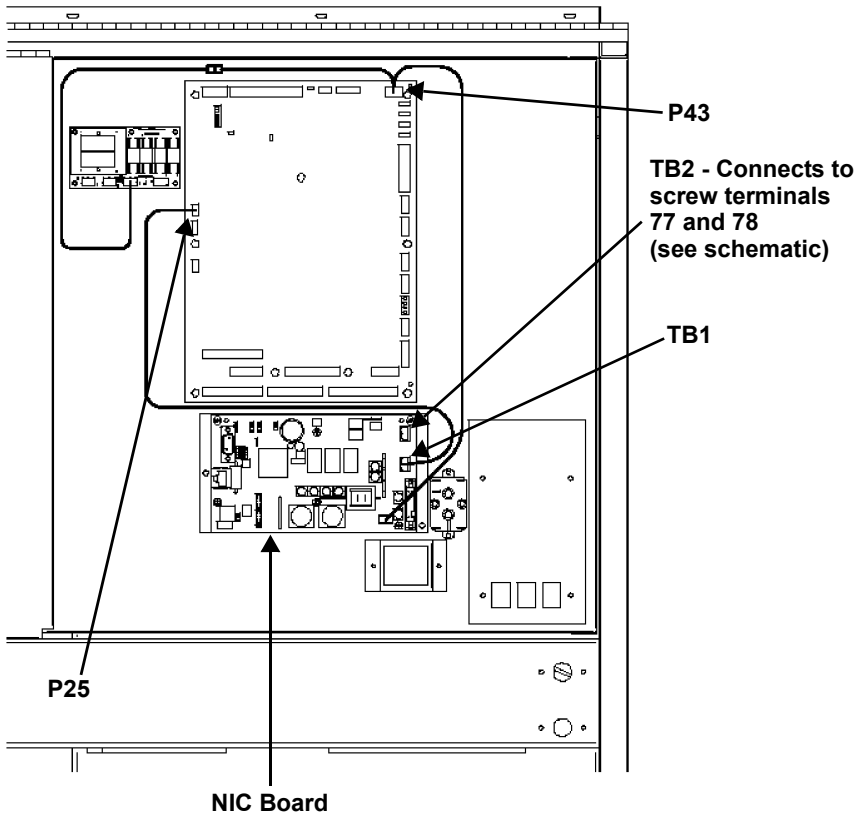
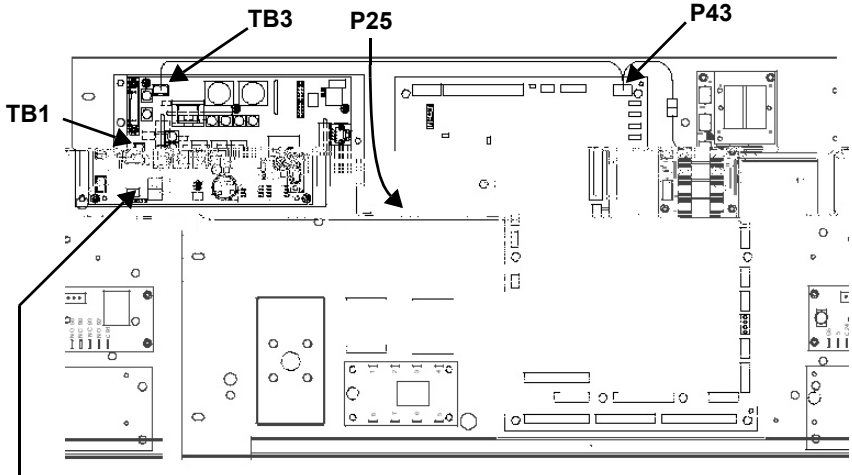


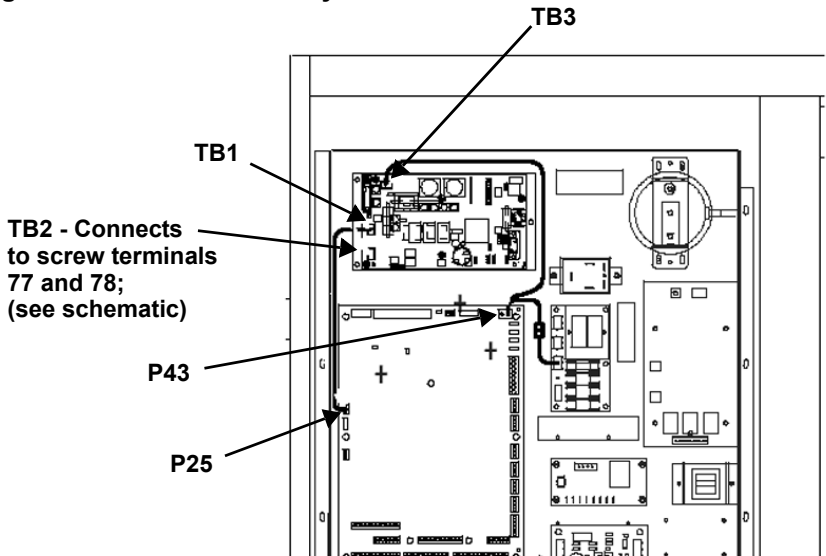


Figure 11 Deluxe System 3 chilled water control cavity



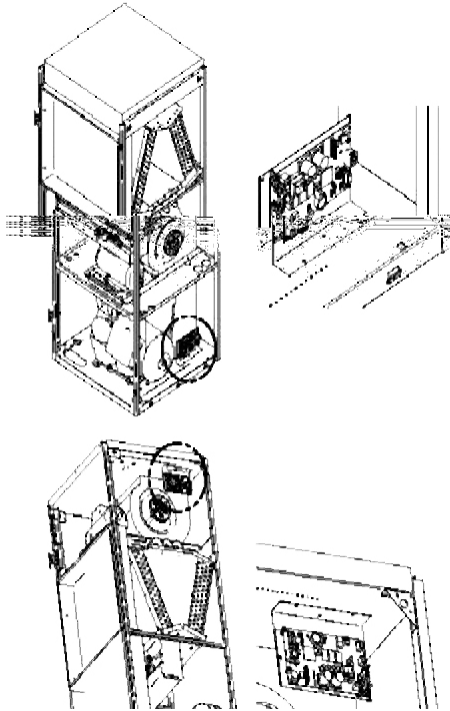
TB2 - Connects to screw terminals 77 and 78; (see schematic)

Figure 12 ICS control cavity

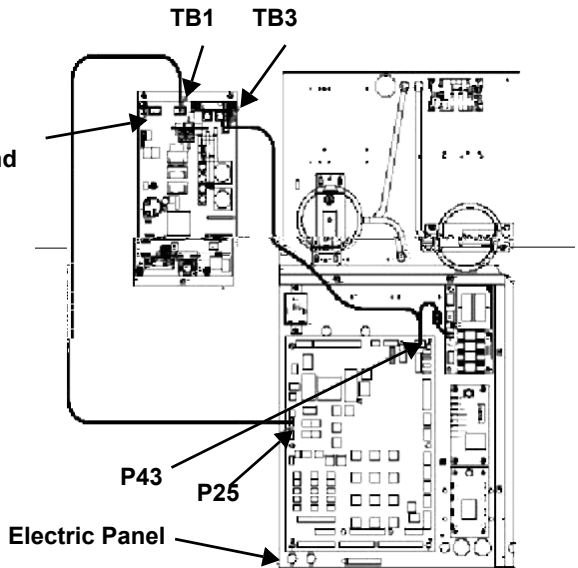


TB2 - Connects to screw terminals 77 and 78; (see schematic)

Figure 13 Challenger installation location



TB2 - Connects to screw terminals 77 and 78; (see schematic)



The OpenComms Network card mounts on the Challenger's L-plate.

## 9.2 System Wiring (SM, AM, AG Microprocessors)

Two wiring harnesses are included with the retrofit kit, one for the power connection and the second for communications. They are of sufficient length for use with the Deluxe System/3 and ICS units and the microprocessors listed above. For the Challenger product series, use the longer wiring harnesses included with the NIC-K-Chall kit.



### NOTE

## 9.3 Power Connection (SM, AM, AG Microprocessors)

The harness supplied with the OpenComms Network Interface Card (p/n 159084G1) is equipped with three connectors, one at either end of the harness and one in the middle. The harness taps power from the 24 VAC input to the control board of the environmental unit. To connect this power to the NIC:

1. Locate the connector containing the two red wires plugged into P43 on the control board and unplug it. Reconnect it to the connector in the middle of the supplied harness.
2. Plug one end of this harness into P43 on the control board and the other end into TB3 of the OpenComms card.

### 9.3.1 Power Connection (Level 0 and Level 10 Microprocessors)

To connect power to the NIC, wire as described above. However, some field modification of the wiring harnesses is necessary for connection to legacy systems.

**Level 0:** Remove the power connector normally plugged into P43 and wire to terminal connections 1-5 (24V)/1-10 (ground).



### CAUTION

Do NOT tap power from the auxiliary 24VAC terminals T5/G5 on the SM/AM/AG environmental controllers. Damage to controller and interface card may occur.

### 9.3.2 Communication Connection (SM, AM, AG Microprocessor)

The second wiring harness provided (p/n 159083G1) has a connector fitted at either end and is the communications connection between the unit microprocessor and the NIC.

To put it in the system:

1. Remove the existing wire located on P25 of the environmental controller, cut off the red connector and reconnect the wires to TB2 of the interface card. Ensure correct polarity.
2. Connect one end of the wire harness to TB1 of the interface card; the other end connects to P25 of the environmental controller.

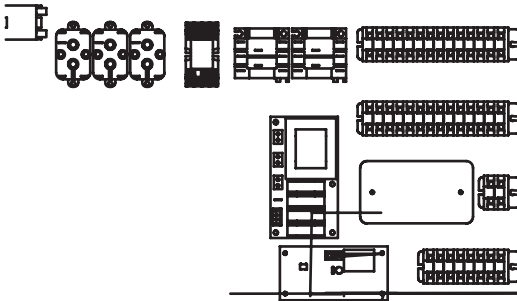
### 9.3.3 Communication Connection (Level 0 and Level 10 Microprocessors)

To connect communications wire to the NIC, wire as described above. Some field modifications of the wiring harnesses are necessary for connection to legacy systems. Level 0 and Level 10: Remove the red connector normally plugged into P25. Wire to terminal connection P25.

### 9.4 Himod (LNA)

Position the OpenComms card in the low voltage/control cavity of the Liebert Himod unit. Refer to the drawing below for typical positioning. Use three #8 x 1/2" sheet metal screws to affix mounting plate to the Environmental unit.

**Figure 14 Himod NIC installation location**



### **9.4.1 System Wiring (Himod)**

Two wiring harnesses are included with the retrofit kit, one for the power connection and the second for communications. They are of sufficient length for use with the Himod unit.



#### **NOTE**

### **9.4.2 Power Connection (Himod)**

The harness supplied with the OpenComms Network Interface Card (p/n 159084G1) is equipped with three connectors, one at either end of the harness and one in the middle. The harness taps power from the 24 VAC input to the control board of the environmental unit. To connect this power to the NIC:

1. Locate the connector containing the two red wires plugged into P43 on the control board and unplug it. Reconnect it to the connector in the middle of the supplied harness.
2. Plug one end of this harness into P43 on the control board and the other end into TB3 of the OpenComms card.

### **9.4.3 Communication Connection (HiMod)**

The second wiring harness provided (p/n 159083G1) has a connector fitted at either end and is the communications connection between the unit microprocessor and the NIC.

To put it in the system:

1. Remove the existing wire located on P25 of the environmental controller, cut off the red connector and reconnect the wires to TB2 of the interface card. Ensure correct polarity.
2. Connect one end of the wire harness to TB1 of the interface card; the other end connects to P25 of the environmental controller.

## **9.5 Mini-Mate2**

An enclosure is recommended for use with ceiling-mounted environmental units or where internal mounting of the Network Interface Card is not feasible. Older-generation Deluxe and Challenger units may also require external mounting.

## **9.6 Emerson Network Power (CEMS100 / LECS15)**

The kit includes a special cable to allow simple interconnection between the controller and the OpenComms NIC.

Questions about the retrofit kits should be directed to the International Sales department.

Contact: [yc.kok@emersonnetwork.com.au](mailto:yc.kok@emersonnetwork.com.au)

## **9.7 UPS Installation**

Retrofit kits are designed specifically for individual units. Consult your local sales / service representative for pricing, part numbers and installation help.

## **9.8 Npower**

As a minimum there will be an IFM board (communications interface) mounted at the mid-point on the door. Other options may also have been previously installed.

The Option boards mount on the inside of the option door. Options can be located in any available option slot, however the **OpenComms NIC** should be mounted in the bottom most (bottom cable entry) position.

### **9.8.1 Power Connection for NPower**

After mounting the NIC card in the uppermost or lowermost option position, per the instructions above, route the wire harness from TB3 on the lower left of the NIC card to the power supply board on the back of the control door. Follow the routing path indicated in Figure 7.

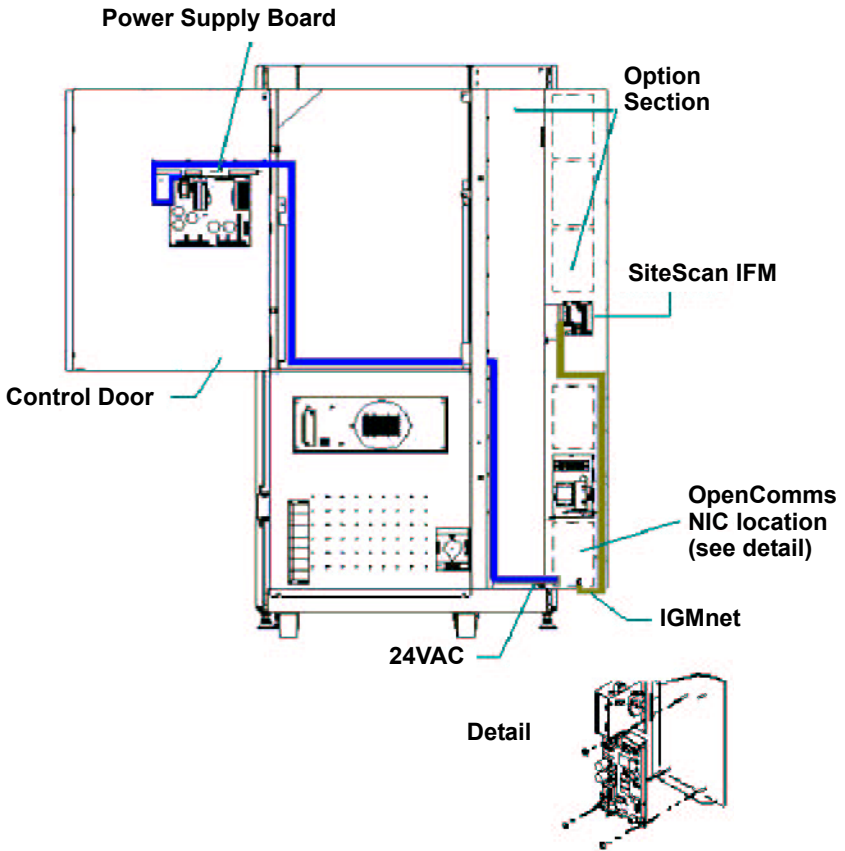
### **9.8.2 Communication Connection for NPower**

Connect the 2-wire harness from TB1 on the bottom center of the NIC card to TB55 on the IFM card. The board is now ready to connect customer inputs, which should be routed from either the top or bottom cable entry points.

Refer to the NPower option manual for any further details on installation.

See **Figure 15** for single line detail.

Figure 15 NPower UPS NIC installation



## **9.9 7200 UPS**

Retrofit Kits are designed specifically for individual units. Consult your local sales / service representative for pricing, part numbers and installation help.



### **CAUTION**

Before installing the kit P/N 4645114G for Network Interface Card (P/N 4590063X), in the 7200 Series UPS, it is necessary to power down that unit. To maintain continuity of supply, the load should first be transferred to the maintenance bypass circuit following the procedure given in the UPS user manual.

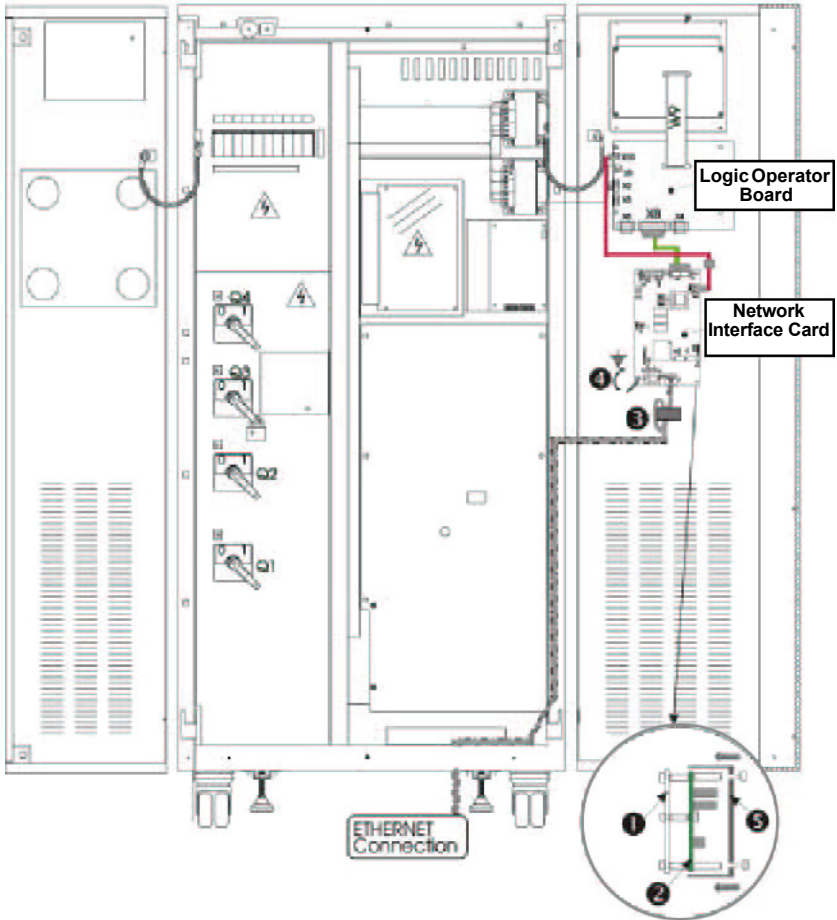
Refer to the UPS user manual for more details.

If you encounter any problems with the procedures contained in this manual contact your local Liebert representative or Liebert's Customer Service and Support Department at:

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Customer Service and Support Department  
Fourth Avenue  
Globe Park  
Marlow  
Buckinghamshire SL71YG  
Telephone: +44 (0) 1628 403 200  
Fax: +44 (0) 1628 403 296



Figure 16 7200 UPS NIC installation



## **9.10 HiPulse UPS**

Retrofit Kits are designed specifically for individual units. Consult your local sales / service representative for pricing, part numbers and installation help.



### **CAUTION**

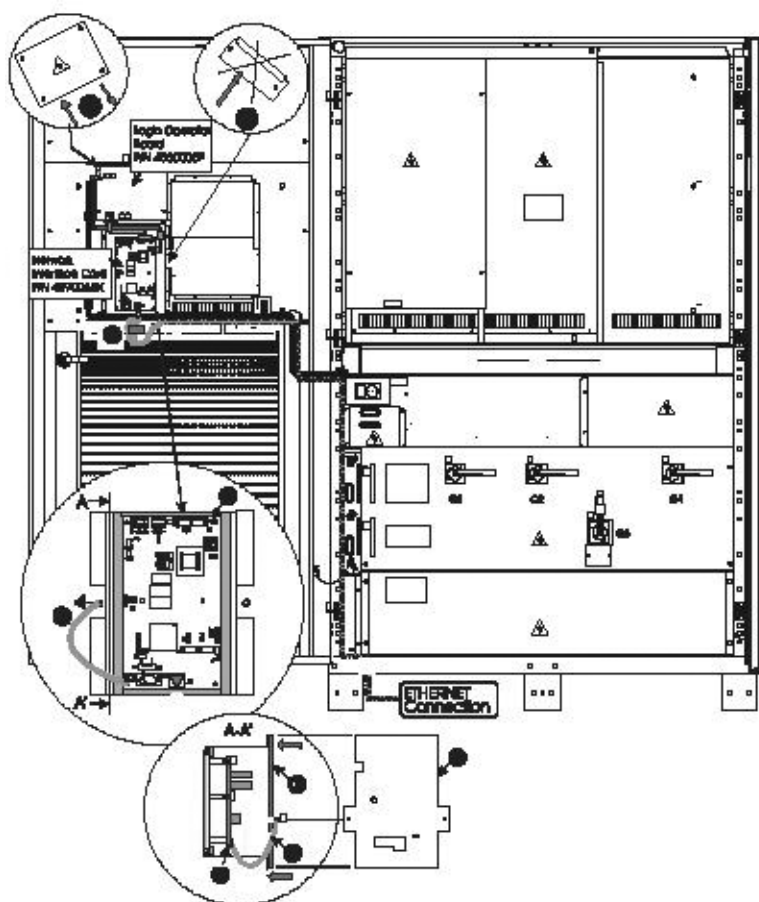
Before installing the kit P/N 4645114D for Network Interface Card (P/N 4590063X), in the HiPulse UPS, it is necessary to power down that unit. To maintain continuity of supply, the load should first be transferred to the maintenance bypass circuit following the procedure given in the UPS user manual.

Refer to the UPS or Network Interface Card user manual for more details.

If you encounter any problems with the procedures contained in this manual contact your local Liebert representative or Liebert's Customer Service and Support Department at:

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Customer Service and Support Department  
Fourth Avenue  
Globe Park  
Marlow  
Buckinghamshire SL71YG  
Telephone +44 (0) 1628 403 200  
Fax +44 (0) 1628 403 296

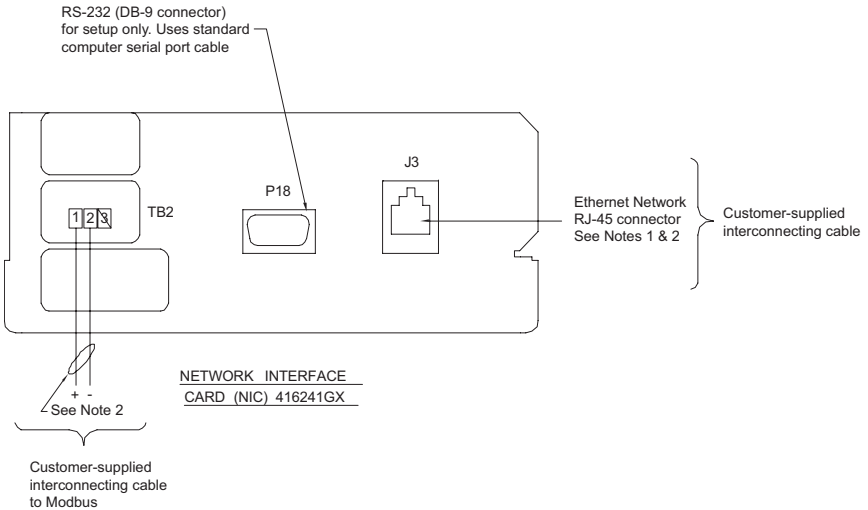
Figure 17 HiPulse installation



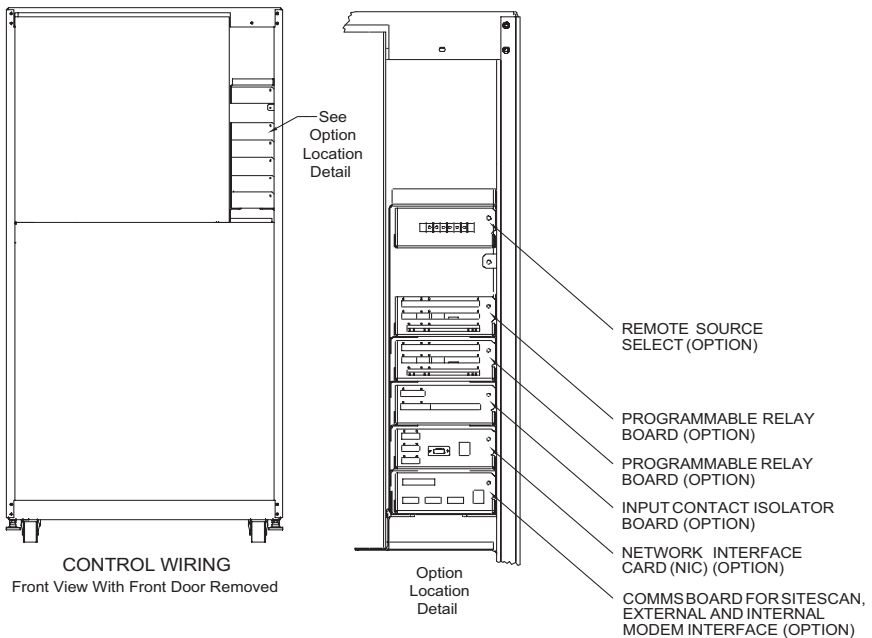
## 9.11 Static Switch2

Retrofit kits are designed specifically for individual units. Consult your local sales / service representative for pricing, part numbers and installation help.

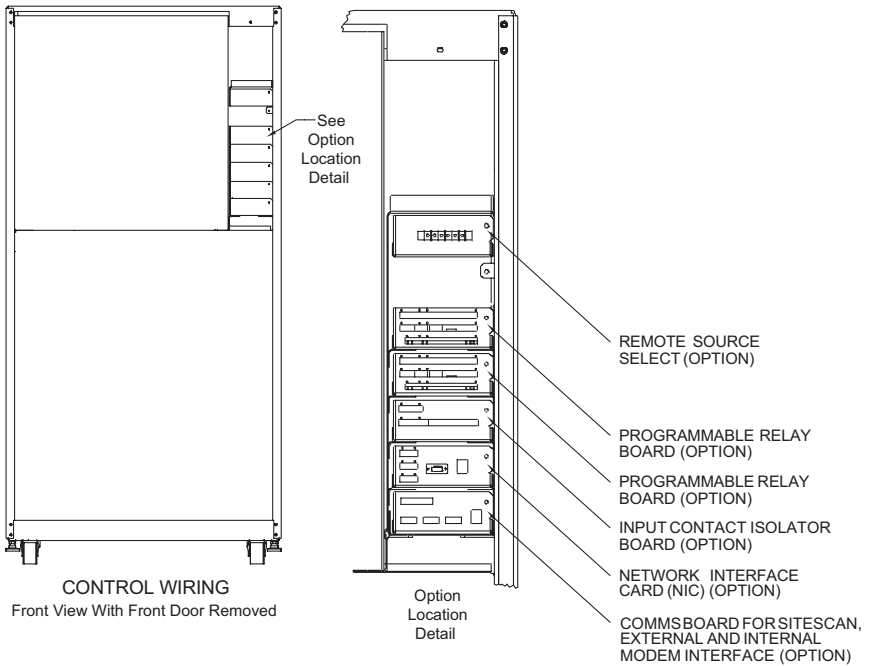
**Figure 18 STS2 typical NIC location**



**Figure 19 STS2 NIC installation, 800-1000A units**



**Figure 20 STS2 NIC installation, 100 - 600A units**



## 9.12 STS

Retrofit kits are designed specifically for individual units. Consult your local sales / service representative for pricing, part numbers and installation help.

STS units require the use of an external enclosure. Consult the corresponding section of this manual regarding installation details.

## 9.13 PDU and DataWave with PMP & EPMP

Retrofit Kits are designed specifically for individual units. Consult your local sales / service representative for pricing, part numbers and installation help.

All compatible PDU's and DataWave's require the use of an external enclosure. Consult the corresponding section of this manual regarding installation details.





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